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Radiation Induced Conductivity and Cathodoluminescence of Disordered SiO_2

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High energy electron radiation incident on highly disordered insulating materials (HDIM) deposits both charge and energy. The spatial and energy distribution of localized trap states in HDIM and their occupancy lead to competing processes, including space charging, electrostatic discharge, radiation induced conductivity, and cathodoluminescence. Measurements of these processes for highly disordered SiO_2 over a range of temperatures will be presented. A simple theory—based on thermally-assisted hopping conductivity, disordered band theory and the transition that takes place between electrons in extended conduction states and localized trapped states associated with structural or compositional defects—will be presented to model these competing processes.